

The Use of Silicones in Dermatology

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AMONG THE MORE SIGNIFICANT topical preparations that have appeared in the dermatologic field during recent years are the silicone-containing agents. The pronounced ability of these dimethylsiloxane polymers to repel moisture while remaining inert, non-sensitizing and nontoxic^{2, 15, 16} has given impetus to widespread acceptance and use. Numerous commercially available preparations, ranging in silicone content from 2 per cent to 55 per cent, have been found of value in the treatment and prevention of diseases of the skin associated with prolonged exposure to moisture, soaps and detergents, irritating body discharges and certain allergens and chemicals.^{4, 12, 20}

Among cutaneous conditions reported as benefited by silicone preparations are soap-water-detergent dermatitis of the hands (housewives' eczema, "dish-pan hands"), contact dermatitis due to primary irritants and specific allergens, "diaper rash," peristomal dermatitis, chapping of lips, hands and face, angular stomatitis not due to vitamin deficiency,¹³ pruritus of the vulvae and the anus secondary to body discharges and atopic dermatitis due to contact factors. Many persons consider the silicone preparations now in use to be cosmetically objectionable. In addition, in view of the nature, pathogenesis and sequelae of many of the diseases of the skin treated with silicones, it would seem desirable to combine the repellent properties of the material with a keratolytic agent and a bactericide, thereby broadening the therapeutic scope.

A consideration of housewives' eczema or "dish-pan hands," the most common of all "industrial" dermatologic diseases, will serve to illustrate the desirability of a multiple-acting topical application. It is generally agreed that numerous background factors such as increased capillary permeability, allergy, atopic states, psychosomatic factors, endocrine disturbances, focal infections, avitaminosis and seasonal change may predispose certain persons to dermatitis of this type.^{7, 18, 19} However, it is likewise accepted that the defatting action of soap, water and detergents, coupled with the alkalinity of

• A cosmetically acceptable lotion containing a silicone protectant, a keratolytic, a bacteriocidal agent and antipruritic substances, was clinically tested in 208 persons with various dermatoses.

Twenty-four-hour closed patch tests on humans and intradermal tests in laboratory animals indicate the lotion not to be a sensitizer.

Subacute and chronic housewives' eczema and contact dermatitis of the hands, uncomplicated "diaper rash," periauricular dermatitis due to excessive moisture, and certain hyperkeratotic dermatoses responded satisfactorily to the use of the lotion.

soaps, most frequently precipitate housewives' eczema.^{5, 9} In addition to the soap, water and detergent effects already mentioned, Van Scott and Lyon²¹ demonstrated that detergents cause the loss of sulfhydryl groups from the keratin molecule, thereby altering the previously compact keratin structure and diminishing its inherent powers of protection. Sutton and Ayres and others pointed out a similar effect from alkalies such as soaps.^{6, 19}

Once dermatitis of the hands is established, an endless variety of physical, bacterial and chemical agents can maintain the process despite removal of the original offending agents. As sequelae, pathologic changes in the epidermis and cutis consisting of erythema, thickening, scaling, fissuring, peeling and dryness or chapping frequently occur. Secondary infection is not an uncommon complicating factor. Frequently pruritus, stinging and burning are symptomatic accompaniments of the dermatitis. In view of these multiple pathologic sequelae of housewives' eczema, it would seem that protection from the offending agents alone is not sufficient and that a broader therapeutic approach is desirable to speed recovery.

MATERIALS AND METHODS

In view of the above considerations, a cosmetically acceptable lotion* was prepared containing the following ingredients: silicones (Dow-Corning 200 or 555) 1.5 per cent; glyoxyl diureide, 0.2 per cent;

*Marketed under the name Silicare,® a product of the Pharmacal Division, Revlon Products Corporation.

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Aided by a grant from and materials supplied by the Pharmacal Division, Revlon Products Corporation, New York 22, New York.

Presented before the Section on Dermatology and Syphilology at the 83rd Annual Session of the California Medical Association, May 9-13, 1954, Los Angeles.

camphor, 0.1 per cent; menthol, 0.1 per cent; hexachlorophene, 0.25 per cent; in an ethanolamine stearate lotion.

The inclusion of a substance that would favorably affect the keratin layer of skin, promoting healing by epidermal stimulation and debridement of necrotized superficial keratin, should be a valuable adjunct in topical therapy of the kind of dermatitis under discussion. Such a substance is thought to be present in glyoxyl diureide, a uric acid derivative.

Although McAllister,¹⁰ as early as 1912, described the healing effects of this substance, it was Robinson's¹⁴ publication in 1935, showing the active ingredient of live maggot therapy to be glyoxyl diureide, that gave impetus to the use of this chemical in this country. He found this material to exert definite healing properties, to be inexpensively made, stable and nonirritating. Ayres, Anderson and Taylor¹ demonstrated the applicability of maggot therapy and its associated glyoxyl diureide production in dermatologic conditions involving chronic ulcerative or granulomatous processes. Mecca¹¹ in a review article cites the digestive action of glyoxyl diureide as well as its cell-proliferant properties. Greenbaum⁸ demonstrated the leukocytogenic property of the chemical following systemic administration and believed its topical healing action to be due in part to a locally-produced leukocytosis.

Because of the incidence of secondary infection in dermatitis, it was deemed desirable to combine a relatively nonsensitizing and effective bacteriocidal agent into the silicone-glyoxyl diureide preparation. Hexachlorophene^{3, 17} in one-fourth per cent concentration was selected for this purpose.

To help control the pruritus, burning and stinging that so often accompany eczema of the hands, small amounts of camphor and menthol were added to the formula. Studies were then begun to determine the value of such a preparation in certain dermatologic conditions.

TOXICITY AND SENSITIZATION STUDIES

Preliminary investigation of the lotion in laboratory animals consisted of topical applications for 21 days, vaginal instillations for a similar period, intracutaneous sensitization tests and instillations into the eyes. None of these studies revealed evidence of significant irritative phenomena or tissue injury on macroscopic and/or microscopic examination. No sensitivity could be produced after 20 days of intracutaneous injections followed by a two-week rest period and then reinjection. In 24-hour closed patch tests with three materials—a lotion containing Dow-Corning 200 silicone, a lotion containing Dow-Corning 555 silicone, and Dow-Corning 555 alone—on the arms of 217 human subjects, there were no positive reactions. Eye instillation studies indicated the

TABLE 1.—Occurrence of eye irritation (0.1 ml. instillation each eye)

Rabbit No.:	1	2	3	4	5	6	7	8	9	10
Time										
1 hour.....	+	*	0	+	+	+	+	0	0	0
24 hours.....	0	0	+	0	0	0	0	0	0	0
48 hours.....	0	0	0	0	0	0	0	0	0	0

*Positive reaction—hyperemia of conjunctiva.

TABLE 2.—Results of use of materials in treatment of dermatitis of hands

	No. of patients	Complete healing	Partial healing	No healing
<i>Housewives' Eczema</i>				
1. Defatted, chapped.....	74	69	5
2. Defatted with active dermatitis	35	26	8	1
Subtotal	109	95	13	1
<i>Contact Dermatitis</i>				
1. Subacute	24	19	3	2
2. Chronic	14	7	5	2
Subtotal	38	26	8	4
Total	147	121	21	5

lotion had singularly little irritating effect on that organ (Table 1). Bacteriocidal activity was demonstrated by the complete suppression of growth of four test organisms after a five-minute exposure of 0.1 cc. each of pure culture to 1 gm. of the lotion tested.

CLINICAL MATERIAL AND RESULTS

Suitable subjects for this study were selected from patients treated in a clinic, in private practice and in hospitals and from hospital employees of various occupations. The use of the lotion was studied in subacute and chronic phases of dermatitis only. Previous experience with silicone preparations had established these agents to be not only ineffective, but at times poorly tolerated in many acute weeping eczematous processes. While a total of 306 subjects were given the lotion, only 208 are reported upon here because of inadequate follow-up in 98 instances. Duration of treatment ranged from a few days to several months.

Housewives' eczema, "dishpan hands," was the largest single category in this study, 109 subjects participating. The patients were selected on the basis of history and clinical observations. Their hands were characterized by varying degrees of erythema, roughness of texture, defatting, cracking, scaling, fissuring, lichenification and accompanying discomfort. In all cases the disease was in the subacute or chronic phase. An arbitrary classification placed these patients in two groups. The first consisted of subjects with mild dryness, redness and/or scaling. The second group was composed of persons with

TABLE 3.—Occupational distribution of hand dermatitis

	No. of patients	Results		
		Complete healing	Partial healing	No healing
Housewife	38	33	3	2
Kitchen employee	21	18	3
Professional housecleaner	19	15	3	1
Laundry worker	13	12	1
Nurse and aide	23	17	5	1
Seamstress	3	1	2
Laboratory technician	4	3	1
Miscellaneous	26	22	3	1
Total	147	121	21	5

TABLE 4.—Results of treatment of other kinds of dermatosis

	No. of patients	Complete healing	Results Partial healing	No healing
<i>"Diaper Rash"</i>				
1. Uncomplicated	19	18	1
2. Complicated	12	2	1	9
Total	31	20	2	9
Angular stomatitis, cheilitis, cheilitis and "saliva eczema"	14	11	2	1

the same conditions but of greater intensity and accompanied by fissuring, thickening and lichenification. Results of treatment are shown in Table 2. It was noted that in patients with an extreme degree of dryness and fissuring only slight improvement was noted until a supplementary emollient was prescribed to be used nightly. These patients then made rapid progress, but the results obtained after the addition of the emollient are not included in this study.

All the 38 patients with contact dermatitis of the hands other than housewives' eczema (Table 2) were kept at their work while using the lotion and 26 of the 38 had satisfactory improvement despite continued exposure.

Occupational classification of the subjects with dermatitis of the hands and the response obtained are shown in Table 3.

Results of use of the lotion in treatment of 31 infants with "diaper rash" and of 14 patients with angular stomatitis, cheilitis and/or "saliva eczema" are shown in Table 4.

Seven patients with atopic dermatitis were treated. One of them, in whom the disease was caused by a specific allergen, had partial healing. Of six cases due to undetermined allergens, one responded with complete healing, three partially improved and two did not heal. Of three patients with numular eczema, one had partial improvement and two had none.

Six persons with follicular hyperkeratosis or hyperkeratotic dermatoses were treated, of whom two had complete healing and four had partial healing. However, all these patients had been under treatment for only two to three weeks, and the response

elicited was striking. This group will be considered further.

DISCUSSION

In evaluating the results obtained in dermatitis of the hands, it must be borne in mind that a large proportion of the cases treated were of a mild degree of involvement that ordinarily would not cause the patient to seek a dermatologist's help. However, such cases make up the largest single group of "industrial" dermatoses and are the forerunners of most instances of severe and disabling dermatitis of the hands. The significance of clearing housewives' eczema before more severe pathological change occurs is obvious. To this end, the role of the lotion studied is conclusively demonstrated. The cosmetic acceptability of the preparation was frequently commented upon; particularly as to the nongreasy, non-sticky and invisible characteristics. Antipruritic properties were observed in many instances, sometimes due to the healing effected and at other times due to the immediate application.

One of the more striking effects observed was the rapidity with which hyperkeratinization, as evidenced by roughness, scaling and thickening disappeared. This characteristic evoked frequent spontaneous comment from patients. As was previously noted, persons with an extreme degree of dryness or pronounced fissuring had only partial improvement until an emollient was prescribed as a supplementary nightly treatment. Evaluation of these patients for this study was based only on response up to the time the emollient was added. Most of the instances of "partial improvement" in dermatitis of the hands were in patients whose skin remained excessively dry.

Tolerance to the lotion was extremely good, with only a few instances of irritation. This occurred mostly in the complicated "diaper rash" group. Secondary infections, concomitant atopy, and severe, although subacute, dermatitis made up most of the complications.

The results obtained in "saliva eczema" due to drooling, licking, thumb-sucking and lip-biting, indicate the lotion to be of considerable value in treatment and prevention.

The findings in the very small group of patients with atopic dermatitis studied were inconclusive. Unsatisfactory response of numular eczema was observed in the three cases treated.

One of the more interesting observations made in this study was the effect of the lotion upon keratosis pilaris and other hyperkeratotic states. One of the participating pediatricians prescribed the lotion for a six-year-old patient who had an extreme degree of ichthyosis and keratotic plugging on the arms, thighs and legs. After one week of therapy, a decided

change was noted, and by the end of the second week improvement was pronounced. In all, six patients with hyperkeratotic dermatoses were treated, with two completely healed and four having partial but decided improvement. Further investigation along this line is being carried out.

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ACKNOWLEDGMENT

The authors wish to express appreciation to Drs. H. Bernstein, D. Goldstein and A. Grossman for their participation in the pediatric aspects of this study.

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